

EPA-600/2-77-020
April 1977

Environmental Protection Technology Series



MOVEMENT OF SELECTED METALS, ASBESTOS, AND CYANIDE IN SOIL: APPLICATIONS TO WASTE DISPOSAL PROBLEMS



Municipal Environmental Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

AR002851

ASBESTOS

Finely divided particles of asbestos are an air pollutant and a health hazard and cause lung cancer and a variety of other respiratory problems in human beings. Asbestos is a general term applied to certain minerals that form soft, flexible fibers in metamorphic rocks. The most common asbestos is chrysotile, a variety of the mineral serpentine, a magnesium silicate. Because of its fibrous, insoluble nature it has been used extensively in water filtration processes for clarification and purification. Because it is fireproof and flexible and has a fibrous nature, it is used extensively in fireproof clothing, blankets, heating coil insulation, and insulation placed around furnaces and heaters. It is also blown into attics and walls for insulation.

Asbestos is readily retained by the soil and deposits almost wholly on top of the soil regardless of the vehicle of transport. Colloidal particles $< 2\mu$ may penetrate the soil pores but not for any significant depth. Upon drying, asbestos again may be free for "pick up" by air turbulences unless incorporated into the soil.

Although there are no data on mobility of asbestos in soil, predictions about its behavior can be made with reasonable confidence. Since the weathering products of asbestos are the common nonhazardous salts of Ca, Mg, and Si, physical transport is the only mode of movement in soil which is of significance. The extensive data on movement of clay-sized ($< 2\mu$ diameter) particles by strictly physical processes provide a convenient yardstick for gaging the probable behavior of asbestos in soil. Clay particles 0.1 to 2.0μ in diameter are estimated to move at a rate of 1 to 10 cm per 3,000 to 40,000 years, depending on the soil texture (Berkland, 1974). There is no reason to expect that asbestos particles of similar sizes would move differently from this. Consequently, asbestos migration through soil will not be a problem of any significance.

Microorganisms and nonbiological geologic weathering will separate asbestos into its constituent, harmless parts; namely, calcium, magnesium, and silicate compounds, to join similar naturally occurring soil constituents.

Asbestos degradation, however, proceeds in soils at a very slow rate. Except as a possible dust hazard, asbestos does not offer a serious contamination prospect to the soil or underground water supplies and cannot be classed as a soil pollutant. Plowing or tilling the asbestos into the soil where it can be mixed in great dilution can control its chances of getting into the air as dust again. Surface waters can be polluted by asbestos which is washed into them. Consequently, precautions should be taken to prevent erosion from land disposal areas receiving asbestos.

Control of soil and water pollution from asbestos is straightforward and can be carried out with the technical knowledge which is now available.

BERYLLIUM

Commercial use of beryllium began about 1921. In the early 'forties, its use increased greatly to keep pace with an expanding air transport industry and in the late 'forties as part of the atomic energy development. Today, beryllium is used in many different manufactured products. It alloys with other metals with great strength, hardness, and resistance to corrosion. It is not capable of magnetization and is nonsparking. Precious gems, emerald and aquamarine, are varieties of beryl, $\text{Be}_3\text{Al}_2[\text{Si}_6\text{O}_{18}]$, which contain impurities (Beus, 1956). Chromium impurity yields emeralds, and FeO impart the blue to aquamarine.

Beryllium in certain chemical combinations presents a serious health hazard to those industrial workers susceptible to Be effects. It is particularly dangerous as an air pollutant.

In aqueous solution, only Be^{++} valence state occurs. Beryllium has the smallest radius ($r = 0.3\text{\AA}$) of the metal cations and a hydration number of 4. Hydroxides and fluorides complex Be^{++} in aqueous solutions and may be considered as the most important inorganic ligand in such solutions (Bondietti et al., 1973). Hydrolysis becomes detectable at about pH 3 in concentrations above 10^{-3} M. Precipitation of $\text{Be}(\text{OH})_2$ takes place with increasing pH when about one OH^- ion on the average becomes bound per Be^{++}